HY-G-300®

7403
Bendix Type TE-74

RELIABLE HARD GLASS BEAM TETRODE FOR HIGH VOLTAGE PULSE AND REGULATOR SERVICE

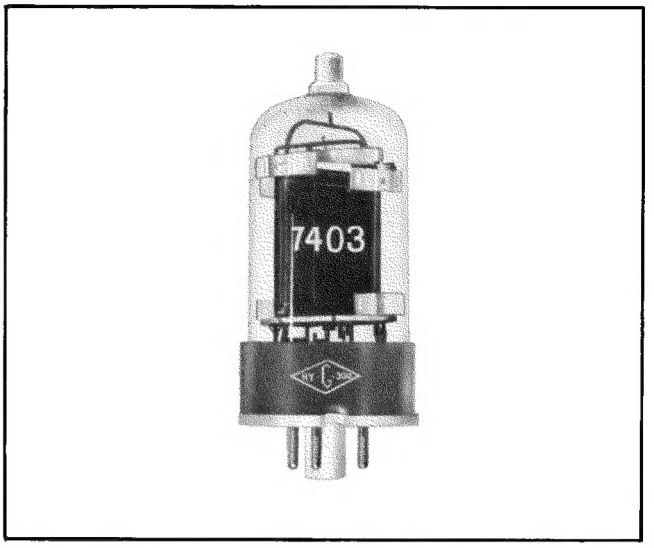
DESCRIPTION

This high perveance beam power amplifier tube is one of the Bendix line of HY-G-300 tubes. It has been designed for high voltage pulse modulator use in aircraft, military, and industrial applications where long pulse life, reliable operation at high voltages during vibration and shock, and freedom from internal arcing are important. Its ability to operate at 4000 volts without arcing and to deliver 10 ampere peaks of cathode current make it ideal for use in such applications or pulse modulators, blocking oscillators, high voltage regulators, switching, deflection amplifiers, etc. The reliable design and processing techniques provide the above characteristics in a package that will operate reliably in military environments.

Each tube is subjected to a high voltage, high energy lint and particle elimination process, and a minimum of 24 hours of pulse operation run-in at high peak cathode currents. This run-in serves to eliminate early failure under operating conditions and to stabilize tubes under pulse operating conditions.

Since this tube is designed for use in equipment with high voltage and where high levels of vibration and shock are encountered, special materials, and processing techniques are employed. Inasmuch as destructive internal arcing usually culminates in ionization, it is important that tubes used at high voltages be extremely well evacuated at high temperatures to remove residual gases which may ionize. The transmitting tube type materials and processing utilized in the Bendix HY-G-300® line result in tubes that are inherently gas free and capable of high dissipation.

The addition of a titanium insert to the anode structure performs a dual function: (1) the gettering capability of



titanium permits the elimination of gettering by conventional barium flash which may induce arcing by coating various insulating surfaces; (2) titanium has the advantage of absorbing contaminatives on its surface which may otherwise dissociate during operation to cause emission slump.

The barrier type glass bonded mica base used on the 7403 not only provides greater arc resistance, but also will not carbonize during a possible arc preventing the build up of a permanently conductive path.

Other special features include a rugged, pure tungsten, helical heater which is used with a high purity aluminum oxide insulator, enabling reliable operation at high heater-cathode voltages.

The design of this tube is a result of extensive engineering evaluation on special impact vibration equipment in which the accelerations equal or exceed those encountered in severe aircraft applications. The shake table used for these studies shock excites the tubes at a repetition rate of 15 cycles per second with a minimum peak acceleration of 50G. These tests indicate that the Bendix 7403 will survive many hours longer, under extremely adverse conditions.

CHART 1. ELECTRICAL RATINGS*

Heater Voltage (AC or DC)	6.3 volts
Heater Current	1.7 amps
Plate Voltage (Max DC)	4000 volts
Screen Voltage (Max DC)	850 volts
Plate Dissipation (Absolute Max)	40 watts
Screen Dissipation (Absolute Max)	3.5 watts
Cathode Current (Max DC Value)	175 mA
Cathode Current (Max Inst. Peak value—of continuous sine wave)	350mA
Cathode Current (Max Inst. Peak Value) Pulse***	10 amps
Heater-Cathode Voltage (Max)	±450 volts
Grid Resistance (Max)	0.1 megohm
Grid Voltage (Max DC)	+5.0 volts
(Min DC)	—200 volts
(Max Inst. Peak Value) Pulse***	+220 volts
Cathode Warm-up Time	45 seconds

*To obtain greatest life expectancy from tube, avoid designs where the tube is subjected to all maximum ratings simultaneously. See application notes.

**Voltage should not fluctuate more than ±5%.

***See pulse rating chart.

CHART 2. MECHANICAL DATA

Base	Large wafer octal, with metal sleeve, 6 pin Glass bonded mica
Bulb	Nonex Glass—T-12
Max Overall Length	4-9/32"
Max Seated Height	3-3/4"
Max Diameter	1-23/32"
Mounting Position	Any
Max Altitude	80,000 feet
Max Bulb Temperature	300°C
Max Impact Shock	500G
Max Vibration Acceleration	50G
(100-hour shock excited fatigue test, sample basis)	
Life Expectancy	5,000 Hours

THE Bendix CORPORATION
Red Bank DIVISION, EATONTOWN, NEW JERSEY

Publication No. R01-11

Printed in U.S.A.

BEAM POWER AMPLIFIER
(PULSE)

HY-G-300

7403
Bendix Type TE-74

ELECTRICAL CHARACTERISTICS AND ENVIRONMENTAL TESTS

CHARACTERISTIC TESTS

CHART 3.

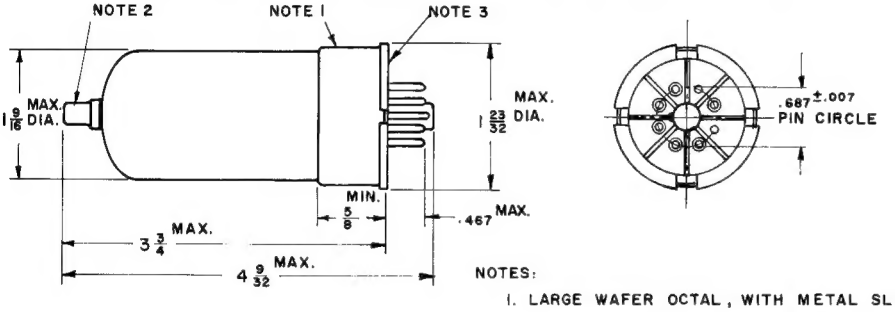
CHARACTERISTIC	SYMBOL	MIN	DESIGN CENTER	MAX	UNITS
PRODUCTION TESTS					
Short and Continuity					
Heater Current	If	1.55	1.70	1.85	A
Heater Cathode Leakage (Ehk = ± 450 Vdc)	Ihk	—	—	50	μAdc
Grid Current	Ic1	—	—	—5.0	μAdc
Plate Current	Ib	28	32.5	37	mAdc
Screen Grid Current	Ic2	—	1.5	3.0	mAdc
Transconductance (1)	Sm	5000	6000	7000	μmhos
Cut off Plate Current (Ec1 = — 180 Vdc, Eb = 4000 Vdc, E_{c_2} = 800 Vdc)	Ib	—	—	300	μAdc
Pulsed Operation	ib	6.0	—	—	a
Pulsed Operation	ic2	—	—	3	a
Pulsed Operation	ic1	—	—	2	a

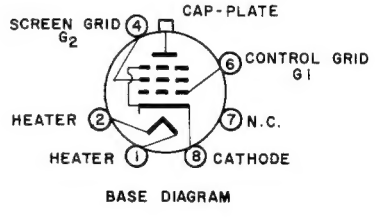
ELECTRODE	Ef	Eb	Ec2	Ec1	Rk	Egk
TEST CONDITIONS	6.3 volts	600 Vdc	300 Vdc	0	825 ohms	—
PULSE TEST CONDITIONS	6.3 volts	600 Vdc	800 Vdc	—180 Vdc	0	+150 v

ENVIRONMENTAL TESTS

CHART 4.

TEST	CONDITIONS	DURATION
Heater Cycling Life Test	On 1 Min Off 4 Min Ef = 7.0 Ehk = 300	2,000 On-Off Cycles
Pulse Life Test	ib = 6.5	500 Hours
Life "Expectancy" Test	Under "Test Conditions"	5,000 Hours
High Level Fatigue Test	50G—Shock Excitation 15 Cycles/Sec.	100 Hours
Shock	500 G	20 Impacts
Altitude Test	80,000 Feet	5 Minutes
Glass Strain Test	Boiling Water to Ice Water	3 Minutes in Each
Swept Freq Fatigue	5G—F = 50—500 CPS	96 Hours





BASE DIAGRAM

NOTES:
1. LARGE WAFER OCTAL, WITH METAL SLEEVE.
2. CAP IS JEDEC C1-2(MODIFIED)
3. WAFER IS GLASS BONDED MICA.
4. ALL DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED.

OUTLINE DRAWING

CHART 5. AVERAGE PLATE CHARACTERISTICS

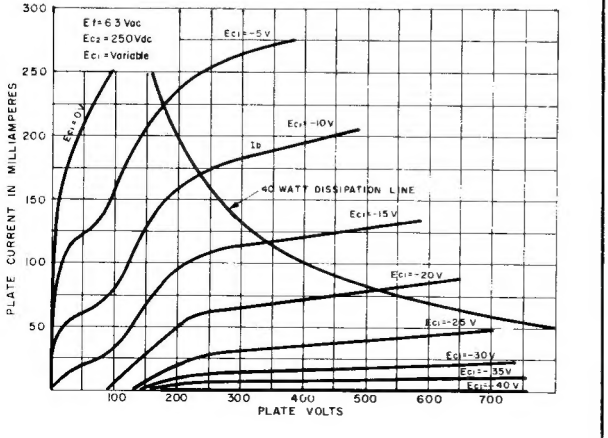
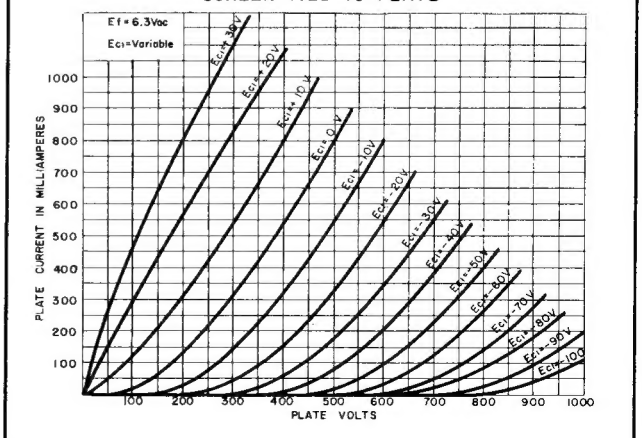


CHART 6. TYPICAL TRIODE CHARACTERISTICS SCREEN TIED TO PLATE



BEAM POWER AMPLIFIER
(PULSE)

MV-G-300

7403
Bendix Type TE-74

ADDITIONAL CHARACTERISTICS

CHART 7.

TYPICAL PLATE CHARACTERISTICS

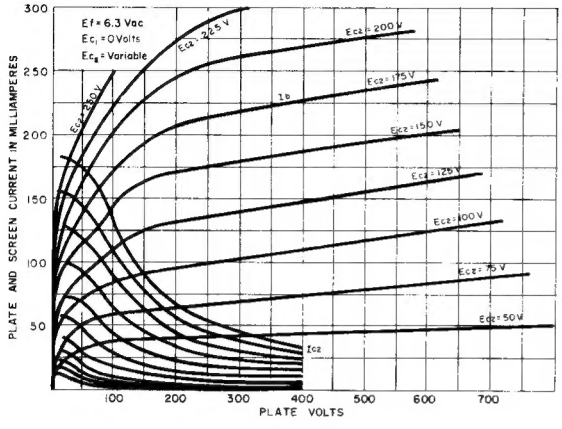


CHART 8.

TYPICAL PLATE CHARACTERISTICS
SCREEN TIED TO CATHODE

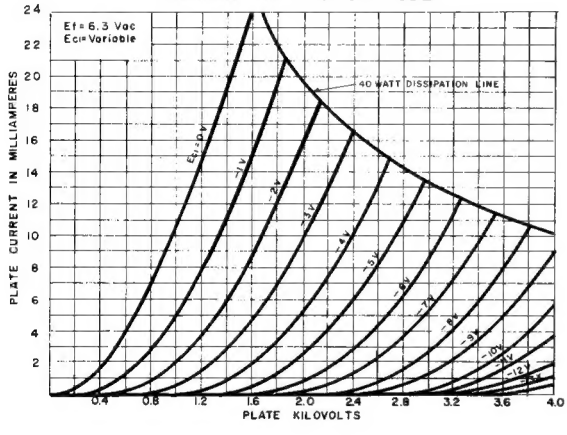
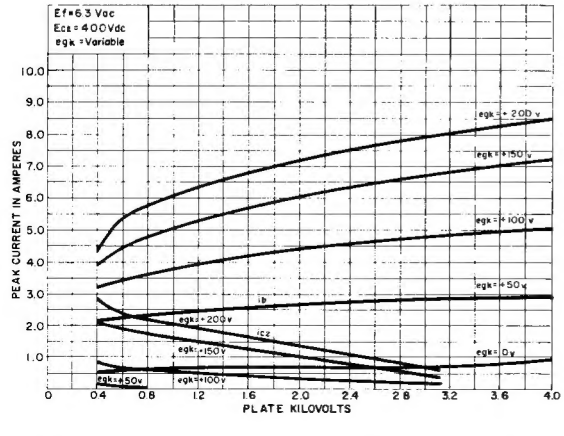


CHART 9.

TYPICAL PULSE CHARACTERISTICS



PULSE CHARACTERISTICS

See CHART 13 page 4 (Pulse Ratings)

CHART 10.

TYPICAL PULSE CHARACTERISTICS

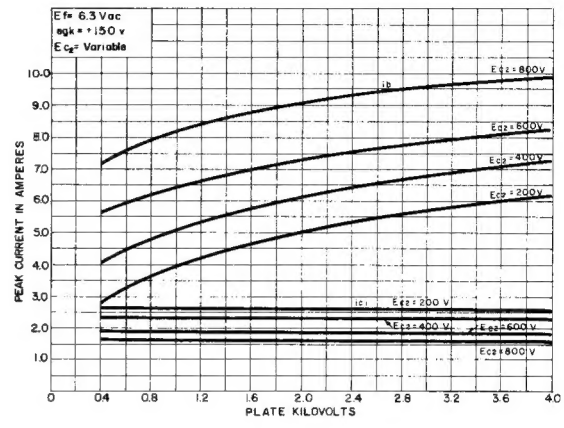


CHART 11.

TYPICAL PULSE CHARACTERISTICS

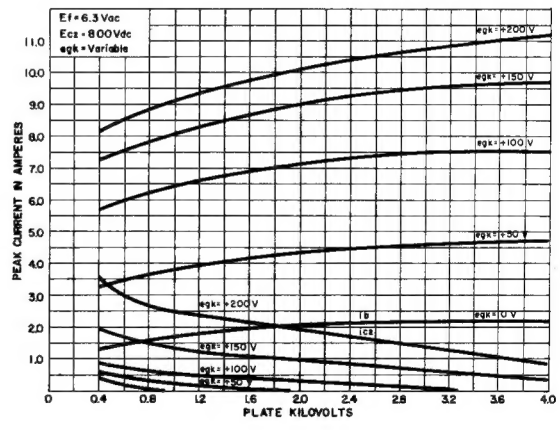
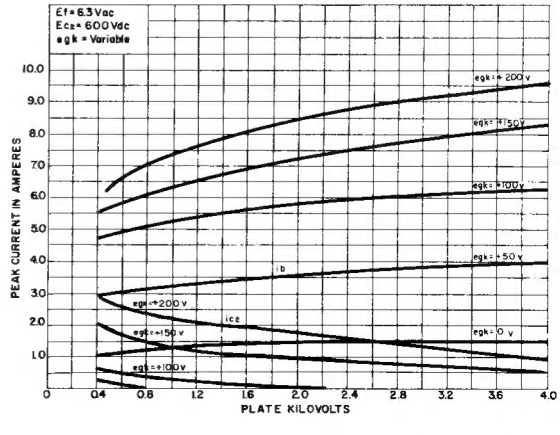


CHART 12.

TYPICAL PULSE CHARACTERISTICS

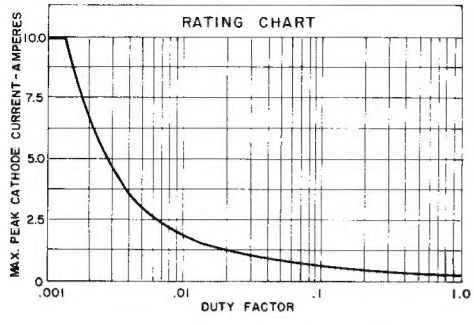


BEAM POWER AMPLIFIER
(PULSE)

HY-G-300

7403
Bendix Type TE-74

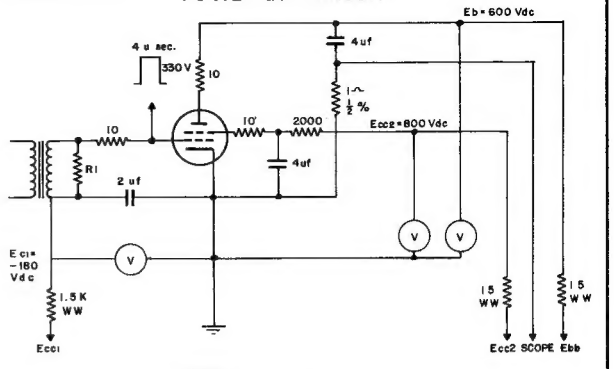
CHART 13. PULSE RATING



DUTY FACTOR (10,000 MICROSECOND AVERAGING TIME) FOR THE 7403 IS DEFINED AS THE RATIO OF "ON" TIME IN MICROSECONDS TO 10,000 MICROSECONDS.

"ON" TIME IS DEFINED AS THE SUM OF THE DURATION OF ALL INDIVIDUAL PULSES WHICH OCCUR DURING ANY 10,000 MICROSECOND INTERVAL.

CHART 14. PULSE TEST CIRCUIT



NOTES:

1. ADJUST R1 FOR MINIMUM RINGING AND OVERSHOOT.
2. PULSE REPETITION RATE = 250 PULSES PER SECOND. DUTY CYCLE < .001

APPLICATION NOTES

Special attention should be given to the temperatures at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy will be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its center rated value.

This tube is constructed using nonex glass and thus can withstand higher ambient temperatures in operation. However, the bulb temperature should never exceed 300°C at its hottest point and cooling should be employed if necessitated by the additive effects of operation at high altitudes and high dissipation simultaneously or by other sources of heat in the equipment.

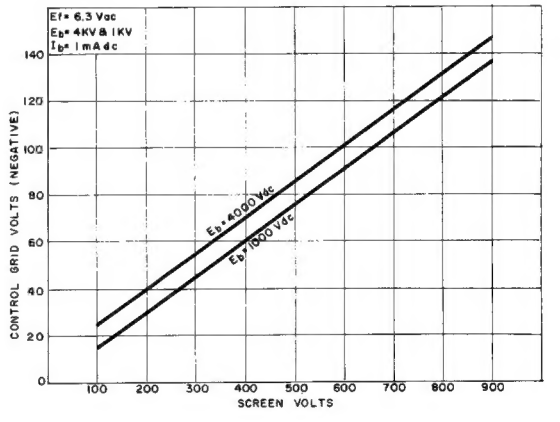
The plate voltage rating and high-perveance of the 7403 make it readily adaptable to varied pulse applications. In order to insure maximum reliability in pulse service the peak plate current should not exceed the value shown in Chart 13 for the required duty factor.

CUT-OFF CHARACTERISTICS

For Ib = 1.0 ma

CHART 15.

TYPICAL CURRENT CUT-OFF CHARACTERISTICS



THE Bendix CORPORATION
Red Bank DIVISION, EATONTOWN, NEW JERSEY

West Coast Sales & Service: 117 E. Providencia Ave., Burbank, Calif.
Export Sales & Service: Bendix International Division,
205 E. 42nd St., New York 17, N.Y.
Canadian Distributor: Computing Devices of Canada, Ltd., P.O. Box 508,
Ottawa 4, Ontario